



tiTelecommunications Investment, Economic Growth, and Universal Service in a Global Economy

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Introduction

In recent years, many countries have implemented reforms in their telecommunications sectors. In developed countries, the primary goal of these reforms has been to foster competition in domestic telecommunications markets. In developing countries, the primary goal has been to increase the availability of telecommunications services across a greater percentage of the population. Additionally, across all countries, there has been a greater reliance on private capital rather than public capital for the development of the telecommunications sector, and there is an overriding need for greater flexibility in order to adapt to rapid technological advances such as in wireless telephony, the Internet, and voice over IP telephony.

A modern telecommunications infrastructure is vitally important for economic growth, for both developed and developing countries. Economists and policy makers have long recognized the vital role played by infrastructure capital (for example, highways, water and sewer lines, etc.) in the economic development of a country. By contrast researchers only recently have determined that investment in telecommunications infrastructure is also a primary source of economic growth.

In an important study, Roller and Waverman found that investment in telecommunications infrastructure significantly affects economic growth of a country once a critical mass of telecommunication infrastructure is present in that country.¹ Interestingly, the critical mass needed to influence economic growth, according to Roller and Waverman, is present when telephone penetration reaches 40 main telephone lines per 100 population, i.e., reaches a level loosely associated with universal service. The Roller and Waverman study also found that once the critical mass level is reached,

¹ Lars-Hendrik Roller and Leonard Waverman, "Telecommunications Infrastructure and Economic Development: A Simultaneous Approach", *American Economic Review*, September 2001, pp 909-923. Other researchers including Norton, Canning, Hardy, Allemen et al., have also found a positive relationship between telecommunications infrastructures and economic growth. See, Seth Norton, "Transaction Costs, Telecommunications, and the Microeconomics of Macroeconomic Growth," *Economic Development and Cultural Change*, Fall 1992, pp 175-196; Andrew Hardy, "The Role of the Telephone in Economic Development," *Telecommunications Policy*, 4(4), 1980, pp 278-286; David Canning, Telecommunications Infrastructure, Human Capital, and Economic Growth, CAER II Discussion Paper 55, Cambridge, September 1999; J. Alleman, C. Hunt, D. Michaels, M. Mueller, P. Rappoport, and L. Taylor, Telecommunications and Economic Development: Empirical Evidence from Southern Africa, International Telecommunications Society, Sydney; Chuka Onwumechili, "Dream or Reality: Providing Universal Access to Basic Telecommunications In Nigeria?," *Telecommunications Policy*, 25(4), May 2001, pp 219-231. Chuka Onwumechili also highlights the importance of critical mass in generating benefits from investment in telecommunications infrastructure in his example for Nigeria.

telecommunications investment has a larger impact on economic growth per dollar of investment than other types of infrastructure investment because telecommunications infrastructure exhibits "network effects."² These findings have important policy implications for developing nations because they must decide the appropriate levels of various categories of infrastructure investment from among competing proposals.

This paper briefly discusses the implications of the Roller and Waverman hypothesis for developing countries. Also discussed are the stages of network development and related universal service policies. The paper then discusses the public policy measures needed to implement universal service under monopolistic and competitive market conditions.

Network development and universal service policies

For those developing countries primarily interested in rapid deployment of telecommunications infrastructure among their populations, basing their telecommunication investment strategies on the policies followed by developed countries may be problematic. In many developed countries with mature telecommunication infrastructure, universal service policies, for example, usually imply nationwide availability, nondiscriminatory access, and widespread affordability of telecommunications services. Adopting similar goals for a developing country may pose potential problems. For example, the goal of affordable service may conflict with the goal of raising sufficient revenues to support investment in network expansion.

For many developed countries, the goal of universal service was achieved in stages. For example, it is only in the last thirty years that the concept of widespread affordability of telephone service, which implies that basic phone service should be available to everyone regardless of where they live and their income level, has been embraced by regulators in United States and Canada. Most European countries have begun to tackle this important issue only recently.

Based on the level of network development as measured by teledensity (the number of main lines telephones per 100 population), Claire Milne has suggested that there are five stages of network development, and these stages influence the choice of policy needed to achieve universal service.³ Briefly, Milne's network development stages range from countries with a teledensity of less than five to countries with a teledensity of more than 50.

For countries belonging to stage one, universal service policy typically focuses on the acquisition of new technology and the need to link all major population centers with a network. Stages two and three of Milne's network development framework are characterized by conditions where telephone service has wide geographic reach within

² Network effects are similar to externalities and imply that the value of a network increases with the number of persons connected to that network. Any additional connection to the network increases the benefit of the network for all users. See Robert Crandall and Leonard Waverman, Who Pays for Universal Service? Washington D.C., The Brookings Institution, 2000.

³ Claire Milne, "Stages of Universal Service Policy," *Telecommunications Policy*, 22(9), 1998, pp 775-780.

the country and is available to a majority of households and businesses. A majority of developed countries belong to stage four, and have a teledensity well above 40. In stage four countries, the goal of universal service is implemented by a policy designed to make telephone service affordable to all regardless of income level by providing targeted subsidies to the needy and those living in high-cost areas. Milne's fifth stage of network development is largely conjectural where telephone service, effectively, is an entitlement and every citizen's basic communications needs are met.

The latest ITU data suggest that most developing nations are still in stage one of network development. According to the ITU, average telephone density in most low-income developing countries will not reach 5 main lines per 100 population until year 2010.⁴ The developing countries, therefore, according to the Roller and Waverman hypothesis, have not reached the critical mass needed for telecommunications infrastructure to contribute disproportionately to economic growth (i.e., contribute more to economic growth per dollar of investment than other types of infrastructure investment). The developed nations, on the other hand, with an average telephone density of above 40 main lines per 100 population, already possess the critical mass needed to enjoy rapid economic growth.

This, however, does not mean that the gap between rich and poor countries will widen further. Developing countries can by-pass some of the stages of development described by Milne, and reach a developed state in terms of their telecommunications sector on par with most of the developed world in a short period of time in terms of telephone service. Moreover, by speeding up their rate of investment in telecommunications infrastructure, most developing countries can gain a boost in their rate of economic growth. For example, in less than 10 years, China has improved its teledensity from less than one in 1990 to 17.8 in 2000. Similarly, Chile saw its teledensity increase from 6.7 (stage two) in 1990 to 44 in 2000 (stage four), a teledensity equaling that enjoyed by many developed countries.⁵ In particular, China has experienced rapid economic growth over the past decade, concomitant with its rapid telecommunications infrastructure development. Perhaps this rapid economic growth was stimulated to some extent by the rapid development of their telecommunications sector and the related network effects that flow from telecommunication investment.⁶ Further research is needed to test the Roller and Waverman hypothesis to determine if network effects from telecommunications investment begin to be felt at lower levels of teledensity, and to determine if, in fact, countries such as China are experiencing the benefits of network effects.

To implement rapid growth in teledensity, many countries have promoted the growth of wireless telephony. In many countries, more people use cellular telephones than fixed line telephones. On average, in 2001, there were more cellular subscribers in Asia, Africa, and Oceania than fixed-line telephone subscribers.⁷ The use of cellular phones

⁴ International Telecommunication Union, Universal Access Executive Summary, *World Telecommunications Development Report 1998*, March 1998, p. 15.

⁵ International Telecommunication Union, Reinventing Telecoms Executive Summary, *World Telecommunications Development Report 2002*, p.16.

⁶ Markus Wauschkuhn, Telecommunications and Economic Development in China, University of Applied Sciences, Bremen, May 2001.

⁷ ITU, *Telecommunications Development Report 2002*, p. 9.

may contribute to the rapid development of a telecommunications network, and make reliance on fixed line telephones less important. Market liberalization, competition, and deregulation also have played an important role in countries experiencing rapid network development.

Universal service policy in a monopoly world

In many countries, telecommunications services are provided by state owned monopolies. Universal service policies in those countries are implemented by requiring the incumbent monopoly telecommunications carrier to cross-subsidize telephone access for rural, poor, and hard- to-serve areas. In the US, prior to 1996, universal service policy was implemented through implicit subsidies from long distance and business telephone service to local and residential services.

For some developing countries, cross subsidization went beyond funds collected from local carriers and, in some cases, even went beyond national boundaries. Telephone carriers in some developing countries have used net receipts from international accounting rate settlements to cross-subsidize local service for certain segments of their population and contribute to their investment in telecommunications network infrastructure. In recent years, the US, which has the largest net settlement deficit among the developed countries, has taken steps to reduce these settlement rates and at the same time the amounts available for such cross-subsidization. This may adversely impact those countries that are heavily dependent on net settlement funds for their telecommunications infrastructure investment.⁸

Economists have questioned the effectiveness of cross-subsidies as a means of providing universal service to low-income individuals and to underserved rural and high-cost areas. For example, in their examination of universal service practices in the US, Kaserman, Mayo, and Flynn conclude that because demand for telephone service in the US is not very price sensitive, the practice of cross-subsidizing local rates from long distance rates has practically no effect on local service penetration rates or on universal service.⁹ Similarly, using data from African and Latin American countries, Clarke and Wallsten concluded that cross-subsidies often have been poorly targeted and have failed to reach poor consumers.¹⁰ Clarke and Wallsten also found that due to the implicit nature of the subsidies used by most developing countries, it is hard to determine who pays and who benefits from them.

⁸ C. Braga, E. Forestier, and P. Stern, Developing Countries and Accounting Rate Reform - A Technological and Regulatory El Nino? *Public Policy for the Private Sector*, Note 172, Washington D.C., World Bank. Using an econometric model, Scott Wallsten found that net settlement rates have no effect on infrastructure investment by a developing country. See, Scott Wallsten, "Telecommunications Investment and Traffic in Developing Countries: The Effects of international Settlement Rate Reforms", *Journal of Regulatory Economics*, 20(3), 2001, pp 307-323.

⁹ David Kaserman, John Mayo, and John Flynn, "Cross-subsidization in Telecommunications: Beyond the Fairy Tale," *Journal of Regulatory Economics*, September 1990, pp 231-241.

¹⁰ George Clarke and Scott Wallsten, Universal(ly Bad) Service: Providing Infrastructure Service to Rural and Poor Urban Consumers, World Bank Policy Research Working Paper 2868, Washington, D.C., July 2002.

Universal service measures in a competitive economy

Since the nineties, many countries have embraced deregulation, privatization, and competition in their telecommunications markets. According to the ITU, at the beginning of 2002, more than half of the countries in the world have fully or partially privatized their previously state-owned incumbent telecommunications company. In some cases, the incumbent telephone carrier now faces competition from unlikely sources. The call back service, for example, which takes advantage of differences in tariffs between developing and developed countries, has taken a large share of the international call market away from the incumbent in many countries. Moreover, in many countries, incumbent monopolists also face competition from IP telephony, Internet telephony, and mobile cellular telephone carriers.

In the US, since 1996, universal service obligations are met through explicit support. The guiding principles of universal service policy in the US are: explicit, specific, predictable, sufficient, competitively neutral, portable among carriers, equitable, and non-discriminatory. Yet, even with these laudable basic principles, universal service policy in the US continues to be a highly controversial regulatory issue.¹¹ The WTO agreement on basic telecommunications also reflects universal service policy principles similar to those in place in the US, i.e., transparent, non-discriminatory, competitively neutral, and non-burdensome. These policy provisions require that telecommunications services should be provided in an open and competitive manner.

In developed countries with incumbent telecommunications carriers, universal service is often used as an argument for and against market liberalization. Many developing countries are reluctant to open their telecommunications markets because they fear competition would lead to higher rather than lower prices for access service. Since prices are based on the cost of providing service, competition may lead newer telecomm carriers to focus on high revenue growth areas and to ignore providing service in unprofitable areas.

Studies, anecdotal evidence, and observations have shown that developing countries experience increased penetration and service availability when competition is present. Competitive telecommunications markets lead to the deployment of new services and higher levels of employment. Incumbent state-owned telecommunications providers, in some cases, are able to keep a substantial market share even in the presence of competition. For example, using data from 30 African and Latin American countries, Scott Wallsten found that competition increases mainline telephone penetration, number of pay phones per capita, and reduces the price of local phone calls.¹² Also, Ben

¹¹ For a critical review of the US universal service policies, see for example, Robert Crandall and Leonard Waverman, *Who Pays for Universal Service?* Washington D.C., The Brookings Institution, 2000; Milton Mueller, *Universal Service*, Washington D.C., The AEI Press, 1997; Gregory Rosston and Bradley Wimmer, "The 'state' of universal service," *Information Economics and Policy*, 12(3) September, 2000, pp 261-283.

¹² Scott Wallsten, "An Economic Analysis of Telecom Competition, Privatization and Regulation in Africa and Latin America," *Journal of Industrial Economics*, 49(1), 2001, pp 1-19.

Petrazzini, notes that the entry of a second state-owned carrier into the market in China during the 1990s dramatically improved the rate of network investment and service deployment.¹³

It is not surprising that competition would have such a dramatic impact on the rate of infrastructure investment in many countries. In many developing countries there is a huge pent up demand for telecommunications services. The ITU estimates that at present 34% of all households in the world have telephone service, but this number could be increased to 55% if service were uniformly available and reasonably priced.¹⁴ Moreover, in many countries revenue from telecommunications services amount to a sizable portion of the gross domestic product. It is possible, therefore, to increase this potential revenue stream rapidly by expanding services to many previously unserved areas and population segments. In some cases, by using innovative service offerings such rural phone cooperative, new entrants have expanded the reach of telecommunications services.¹⁵

In a competitive world characterized by incumbents and new entrants, it is often difficult to decide who should be the purveyor of universal service. Incumbents have used universal service obligations as a way to discourage entry into the market. Similarly, there is a possibility that unless the new entrants also have universal service responsibilities, they will offer services only in the most lucrative areas and siphon away revenues from the incumbent that otherwise could be used to subsidize universal service. It is possible to avoid these potential problems by establishing explicit, competitively neutral support mechanisms, and by allocating responsibility for providing universal service equitably across both incumbents and new entrants. In the US, for example, both incumbents and competitors can become eligible to receive explicit subsidies for serving low-income customers and those located in high-cost areas if they commit to provide universal service throughout a designated area.

In a market driven solution, parties would bid for universal service obligations. A winning bidder may have the most cost effective plan to meet the universal service objectives laid out by the government. For example, Chile established a rural telephone development fund for providing telephone service to unserved areas. It periodically invites bids for nonexclusive licenses to install and operate pay phones, awarding licenses to the bidders requiring the lowest amount of one-time subsidy. In some countries, following privatization, companies were given exclusive concessions to provide local, national and international services.¹⁶ Others have chosen "pay or play" options where the incumbent retains its universal service obligations, but new entrants also contribute a fair share to the universal service fund.

¹³ Ben Petrazzini, Competition in Telecoms -- Implications for Universal Service and Employment, *Public Policy for the Private Sector*, Note 96, Washington, D.C., World Bank, October 1996.

¹⁴ ITU, Executive Summary, World Telecommunication Development Report 2002, March 2002, p. 4.

¹⁵ Bjorn Wellenius, "Extending Telecommunications Beyond the market," *Viewpoint 21463*, Washington, D.C., World Bank, March 2000. Wellenius cites examples from Bangladesh, Brazil, and South Africa where local entrepreneurs, cooperatives and rural telephone facilities have increased telephone penetration.

¹⁶ Bjorn Wellenius, "Extending Telecommunications Service to Rural Areas -- The Chilean Experience," *Viewpoint 105*, Washington D.C., World Bank, March 2000. For example, Brazil, Columbia, Ecuador, and Venezuela have used concessions to build out telecommunications infrastructure.

Unfortunately market based solutions, especially auctions, do not always work. Auctions may not yield a sizable pool of bidders, or there may be collusion among bidders. Similarly, exclusive contracts granted by the government to promote universal service may result in a reduction in innovation and the introduction of fewer new services if the carrier is granted exclusive concessions.¹⁷

Access to telecommunications services may not mean much if the services are not affordable to the consumers who would like to take those services. Often affordability of telephone service hinges on installation charges rather than recurring monthly fees. A targeted subsidy to help defer installation charges may go a long way toward increasing telephone penetration. In the US, a universal service fund has been established to subsidize telephone service to low-income consumers and to consumers living in areas where it is costly to install and maintain telephone service. A universal service fund could be established in developing countries to increase affordability of telecommunications services. The funds could be collected from the incumbent telephone carriers (and competitors, if there are any), or could come from an excise tax on telephone service, or from general government revenues.

Conclusion

Universal service policy is a contentious issue. Developing countries face the problem of providing affordable telephone service to a majority of their citizens starting from a very low infrastructure base. In the past, countries have justified the use of urban-rural cross-subsidies and sometimes have used international rate settlement funds to achieve their universal service goals. In many cases, these cross-subsidies have been found to be ineffective and often market distorting. Recent deregulation and liberalization of the telecommunications sector have forced policy makers to resort to new market-based solutions to solve the problems associated with universal service. Some market based solutions show more promise than others. A successful universal service policy, however, can benefit from a competitive market and a strong and independent regulatory authority with transparent regulatory processes. In cases where affordability is hindering penetration, a targeted universal service fund may produce better results than traditional cross-subsidies.

Economic development and investment in telecommunications infrastructure go hand in hand as evidenced by many developing countries in Asia, Africa and South America. To some extent, economic growth in these countries may have been accelerated by the network effects resulting from increased investment in telecommunications infrastructure. Further research is needed to determine the extent of these possible benefits. One additional benefit of increases in infrastructure in developing countries is

¹⁷ Gasmi, Laffont, and Sharkey empirically evaluated the viability of traditional method of funding universal service using urban-rural cross-subsidy in competitive economy. They found that the cross-subsidies may still be regarded valuable in particular for a developing country. See, F. Gasmi, J.J. Laffont, and W.W. Sharkey, "Competition, Universal Service and Telecommunications Policy in Developing Countries," *Information Economics and Policy*, 12(3), September 2000, pp. 221-248.

the possibility of reduced international call imbalances leading to more balanced international rate settlements between developed and developing countries.